this penultimate moment, readers are confronted with the charge that the greatest proliferation danger of all is the 'obsessive pursuit of nuclear armaments by the existing nuclear weapons states'. Suddenly Walker and Lönnroth identify arms control as the dominant actor:

> Hence the best hope – and possibly the only hope – of strengthening alliance to the non-proliferation regime rests, in our view, on bringing the nuclear arms race under control and eventually reversing it.

This sudden shift causes a sense of confusion. To indicate that non-proliferation policy has to queue up with world concerns about the nuclear arms race moots the central issues of nuclear competition and trade raised by the authors. While the history of the second NPT Review Conference shows that the arms control–non-proliferation link is well established in some quarters, the vicarious injection of this issue at the end of an otherwise tightly knit book serves to dilute its impact.

There are some minor errors and mis-statements which, while they do not detract from the intellectual force of the book, do cause some uneasiness. For example, the authors say that US firms were allowed to transfer enrichment know-how to Australia. While there were strong US hints that sensitive enrichment technology could be provided, transfer was not actually authorized. While such errors are minor quibbles, they cause this reviewer to wonder whether there are comparable errors in the descriptions of nuclear trade policies of other nuclear suppliers.

The book will be of special interest to those that see non-proliferation policy as part of the greater policy spectrum for foreign relations and trade. It will provide little comfort to those who would keep non-proliferation policy independent and well separated from foreign policy and international relations.

On the whole, William Walker and Mans Lönnroth have produced a useful and timely book that should have a reasonably long and intellectual half life. The information it contains and the discussion and argument that it is likely to provoke can only help to improve in form the thinking of those who have the responsibility to formulate and apply policies to keep the world free of more nuclear weapons states in the 1980s and beyond.

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Energy strategy and risk assessment

BRITTLE POWER: Energy Strategy for National Security

by Amory B. Lovins and L. Hunter Lovins

Brick House, Andover, MA, USA, 1982, 500 pp, $17.95

ENERGY RISK ASSESSMENT

by Herbert Inhaber

Gordon and Breach, New York, 1982, 422 pp, $49.50

Every so often a book comes along with sufficient originality to deserve a place on the bookshelves of anyone concerned with energy planning. *Brittle Power* is just such a book. Written by the husband and wife Lovins team, it graphically illustrates the various ways in which contemporary energy systems have been becoming increasingly vulnerable to natural and man-made interruption. Their conclusion calls for a much greater degree of decentralization in energy systems, with an increased reliance on small-scale renewable energy sources.

The book started as a study for the US Defence Civil Preparedness Agency, and thus combines the Lovins' concern with soft energy with a degree of hard policy-oriented analysis which would not have been possible without the official Washington connections.

The message is that our energy systems have been becoming more complex and centralized. The complexity means that they are becoming more brittle, while the degree of centralization means that any disasters have an increasing impact on society as a whole.

Broad coverage

The authors do far more than re-analyse the well known cases such as the 1977 New York blackout, the various nuclear incidents and the potential dangers of LNG. They explain why complexity can make system failures more likely. They deal with the potential role of terrorists. They cover the issue of the electromagnetic pulse (EMP) which accompanies nuclear explosions and which would wipe out unhardened electrical and electronic systems, causing a secondary form of havoc for which we are ill-prepared.

The strength of this book is the range of its sources and the breadth of its analysis. It is essential reading for anyone concerned with energy as a system (or a set of subsystems).

Its weakness is in its remedies. The authors specifically do not believe that everything small is beautiful, accepting that different activities demand energy in different forms and quantities, and that picking the right scale of energy activity does not necessarily mean choosing the smallest. The emphasis is on simplicity, forgivingness and dispersion . . . all unexceptionable goals.

However, they give no clear idea of precisely what priorities planners and citizens should actually have. They present the usual list of alternative energy options, with a far too brief discussion of their relative economics and the particular problems of integrating some of the newer energy sources into existing energy structures. No sense of policy priorities emerges. Many of these new sources are still uneconomic. Precisely how much money should be spent on new energy systems to produce what specific reductions in our energy fragility? This sort of question concerning cost-effectiveness does not really get answered.

It is precisely because the Lovins's leave such awkward questions unanswered that readers should also turn to *Energy Risk Assessment* – a book which springs from a study that Amory Lovins specifically demanded should not be published. Since Inhaber comes from the Canadian nuclear establishment and concludes that nuclear energy is safer than coal and oil, as well as renewables such as methanol, hydroelectricity, wind and most forms of solar energy, such a vigorous response was to be expected.

What Inhaber does is take the complete chain involved in each energy source – from mines to waste disposal. In so doing, he takes into account the coal-miners killed underground and the cancer risks facing their counterparts in uranium mines. He gets his high figures for the renewables by counting the risks involved in assembling the hardware and in the provision of back-up facilities which would be needed if the renewables are to become baseload sources of energy.

Given his professional background and the relative imprecision of many of the statistical sources from which he has had to work, it is easily understandable why his work has proved so controversial. What is fascinating about this book is that he not only gives us the latest workings of his calculations, but provides a 120-page appendix recording his debate with opponents from all round the world (Lovins included). It's been a pretty vicious onslaught, to which Inhaber seems to have responded fairly well, giving ground where his original assumptions or statistics proved wrong. He deals with current data, so his findings need qualifying since there are big uncertainties about how the future safety of the nuclear and renewable industries will move. For the moment, Inhaber convinces me that the soft forms of energy need to be analysed just as rigorously as any conventional energy source in regard to their occupational and environmental hazards. Soft does not inevitably mean benign. The main qualification which must be recorded about his findings is that, as he concedes, he does not account for the proliferation risk attached to nuclear power – and to most neutral observers, it is this risk attached to nuclear power which is qualitatively different from any thrown up by the other energy sources. This does not invalidate his work, which is a challenging (if imperfect) piece of risk analysis. It does, however, mean that the nuclear lobby cannot legitimately use his work as a conclusive piece of work in its favour.

By its nature, this is not the definitive book on the comparative risks involved in different energy sources. New sources of evidence will emerge and estimates will be sharpened as the newer technologies come to be applied more widely. In the meantime, Inhaber has put himself up as a target for other people to aim at. Clearly, there were mistakes in his initial work, but he has undoubtedly triggered off a greal deal of work which will doubtless modify at least some of his conclusions. The fact that his findings run counter to what people would like to believe should not scare readers away from a stimulating book.

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Power system economics

POWER SYSTEM ECONOMICS

by T.W. Berrie

Peter Peregrinus Ltd for the Institution of Electrical Engineers, London, 1983, 314 pp, £27.00, $64.00

Dr Berrie is well known for his lucid and innovative work on the economics of electricity systems. This book brings together much of his work in the form of a reference book, primarily designed for engineers but also for energy economists. It will prove to be a valuable addition to a complex and highly advanced literature, although the publisher's pricing policy for a paperback volume will place the book well beyond the reach of students.

The chapter headings suggest a very comprehensive coverage of power system economics. The scene is set with an overview of world energy developments and the role that electricity has played in those developments. Some basic principles of investment appraisal are then set out and the reader is introduced, very superficially, to the concept of marginal cost pricing. Detailed treatment of marginal cost is postponed until Chapter 9, and the organization of the book is somewhat odd in this respect because the concept of marginal costs is used long before the full explanation is given. There is a strong chapter on reliability of supply, including a detailed analysis of the gains and losses from outages, thus establishing something that power engineers often find unacceptable, namely that, for many countries, planned and intended outages may often have an economic justification in terms of peak capacity investment avoided.

Demand forecasting

The section on demand forecasting would have benefitted from a survey of the limited but sophisticated literature on the modelling of electricity demand, but there is sufficient in the chapter to indicate the salient issues. The same is true for the forecasting sections in Chapters 6 and 7 which should, in any event, have been linked to the discussion of forecasts in Chapter 4.